

CLAIMS

What is claimed is:

1. A method for calculating a scale relationship for an imaging system, the method comprising:
 - (a) selecting a characteristic having a known value, the characteristic associated with an object;
 - (b) acquiring, using the imaging system, an image of at least a portion of the characteristic of the object;
 - (c) finding and measuring the characteristic in the image to provide the measured value;
 - (d) calculating a scale relationship between the object and the image, using the measured value and the known value; and
 - (e) processing the image using the scale relationship.
2. The method of claim 1, wherein the object is a fiber-optic end-face, and wherein selecting the characteristic further includes:
selecting, as the characteristic, a diameter of a substantially annular cladding of the fiber-optic end-face.
3. The method of claim 1, wherein selecting the characteristic further includes:
selecting, as the characteristic, an aspect of a feature of the object, and
wherein finding and measuring further includes:
finding the feature in the image and measuring the aspect of the feature to provide the measured value.
4. The method of claim 1, wherein finding and measuring further includes:
generating at least one model of at least part of the object, the model including the characteristic;

searching the image to find a best match to the at least one model; and
measuring the characteristic of the best match to provide the measured value.

5. The method of claim 1, wherein finding and measuring further includes:
finding the characteristic in the image and measuring an aspect of the characteristic in the
image to provide the measured value.
6. The method of claim 1, wherein processing further includes:
processing more than one image using the scale relationship.
7. The method of claim 1, wherein the characteristic associated with the object is associated
with each object of a plurality of objects, the method further comprising:
(f) repeating (b) – (e) with each of the plurality of the objects.
8. An apparatus for calculating a scale relationship for an imaging system, the apparatus
comprising:
an object having a characteristic with a known value;
an image of at least a portion of the characteristic, the image being acquired by the
imaging system;
finding means adapted to find the characteristic in the image;
measuring means, in cooperation with the finding means, adapted to measure the
characteristic in the image to provide a measured value;
scale means, in cooperation with the measuring means, adapted to determine a scale
relationship between the image and the object, using the measured value and the
known value; and
processing means, in cooperation with the scale means, adapted to process the image
using the scale relationship.
9. The apparatus of claim 1, wherein the object is a fiber-optic end-face, and wherein the
characteristic is a diameter of a substantially annular cladding of the fiber-optic end-face.

10. The apparatus of claim 1, wherein the finding means further includes:
modeling means, adapted to generate at least one model of at least part of the object, the
at least one model including the characteristic; and
searching means, in cooperation with the modeling means, adapted to search the image to
find a best match to the at least one model, and
wherein the measuring means is further adapted to measure the characteristic of the best
match to provide the measured value.
11. The apparatus of claim 1, wherein the characteristic is an aspect of a feature of the object,
and
wherein the finding means is further adapted to find the feature, and
wherein the measuring means is further adapted to measure the aspect of the feature to
provide the measured value.
12. The apparatus of claim 1, wherein processing means is further adapted to process a
plurality of images using the scale relationship, the apparatus further comprising:
a plurality of objects; and
acquiring means, in cooperation with the imaging system, adapted to acquire the plurality
of images of the plurality of objects, respectively.
13. A method for calculating a scale relationship for an imaging system, the method
comprising:
- (a) selecting a characteristic having an aspect with a known value, the characteristic
associated with an object;
 - (b) acquiring, using the imaging system, an image of at least a portion of the
characteristic of the object;
 - (c) finding the characteristic in the image and measuring the aspect of the
characteristic in the image to provide a measured value;

- (d) calculating the scale relationship for the imaging system, using the measured value and the known value; and
- (e) inspecting the object in the image using the scale relationship.
14. The method of claim 13, wherein the object is an end-face of a fiber-optic cable, and wherein inspecting further includes:
- finding potential defects in the image of the end-face;
- measuring the potential defects in the image of the end-face; and
- calculating a physical size of the potential defects using the scale relationship.
15. The method of claim 14, wherein selecting the characteristic further includes:
- selecting, as the characteristic, a diameter of an annular cladding of the end-face of the fiber-optic cable.
16. The method of claim 15, wherein finding the characteristic in the image and measuring further includes:
- generating at least one model of the annular cladding of the end-face of the fiber-optic cable;
- finding in the image a best match to the at least one model; and
- measuring the diameter of the best match to provide the measured value.
17. The method of claim 16, wherein generating the at least one model, further includes:
- generating, as the at least one model, at least one scale-invariant model.
18. The method of claim 14, wherein selecting the characteristic further includes:
- selecting, as the characteristic, a diameter of a stress rod of the end-face of the fiber-optic cable.
19. The method of claim 13, wherein the characteristic associated with the object is associated with each object of a plurality of the objects, the method further comprising:

(f) repeating (b) – (e) with each of the plurality of objects.

20. An apparatus for calculating a scale relationship for an imaging system, the apparatus comprising:
a characteristic having an aspect with a known value, the characteristic associated with an object;
an image, acquired by the imaging system, of at least a portion of the characteristic of the object,
finding means, adapted to find the characteristic in the image;
measuring means, in cooperation with the finding means, adapted to measure the aspect of the characteristic in the image to provide a measured value;
scale means, in cooperation with the measuring means, adapted to calculate a scale relationship between the image and the object, using the measured value and the known value; and
inspecting means, in cooperation with the scale means, adapted to inspect the object in the image using the scale relationship.
21. The apparatus of claim 20, wherein the object is an end-face of a fiber-optic cable, and wherein inspecting means further includes:
defect means, adapted to find potential defects in the image of the end-face;
defect-measuring means, in cooperation with the defect means, adapted to measure the potential defects in the image of the end-face; and
size means, in cooperation with the defect-measuring means and the scale means, adapted to calculate a physical size of the potential defects using the scale relationship.
22. The apparatus of claim 21, wherein the characteristic is a diameter of an annular cladding of the end-face of the fiber-optic cable.
23. The apparatus of claim 22, wherein the finding means further includes:
modeling means, adapted to generate at least one model of the annular cladding;

searching means, in cooperation with the modeling means, adapted to search the image to find a best match to the at least one model; and wherein the measuring means is further adapted to measure the diameter of the best match to provide the measured value.

24. The apparatus of claim 23, wherein the modeling means is further adapted to generate at least one scale-invariant model.
25. The method of claim 21, wherein the characteristic is a diameter of a stress rod of the end-face of the fiber-optic cable.
26. The apparatus of claim 20, further comprising:
a plurality of objects, each object of the plurality of objects associated with the characteristic; and
acquiring means, in cooperation with the imaging system, adapted to acquire an image of at least a portion of the characteristic for each object of the plurality of objects, so as to provide the plurality of images, and
wherein the finding means is further adapted to find the characteristic in each of the plurality of images,
wherein the measuring means is further adapted to measure within each of the plurality of images, the characteristic, so as to provide a plurality of measured values,
wherein the scale means is further adapted to calculate a scale relationship between each of the plurality of objects and each of the plurality of images using the known value and the respective measured value of the plurality of measured values, so as to provide the plurality of scale relationships, and
wherein the inspection means is further adapted to inspect each of the plurality of images using the respective scale relationship of the plurality of scale relationships.
27. A method for calculating a scale relationship for an imaging system, the method comprising:

selecting a characteristic having a known value, the characteristic associated with each object of a plurality of objects;
acquiring, with the imaging system, an image of at least a portion of the characteristic for each object of the plurality of objects, so as to provide a plurality of images;
finding the characteristic in each of the plurality of images;
measuring, within each of the plurality of images, the characteristic, so as to provide a plurality of measured values;
calculating a scale relationship between each of the plurality of objects and each of the plurality of images using the known value and the respective measured value of the plurality of measured values, so as to provide the plurality of scale relationships; and
processing each of the plurality of images using the respective scale relationship of the plurality of scale relationships.

28. The method of claim 27, wherein finding the characteristic in the image further includes:
generating at least one model of at least part of the object, the model including the characteristic; and
searching the image to find a best match to the at least one model, and
wherein measuring the characteristic further includes:
measuring the characteristic of the best match to provide the measured value.
29. The method of claim 27, wherein the object is a fiber-optic end-face, and selecting the characteristic further includes:
selecting, as the characteristic, a diameter of a substantially annular cladding of the fiber-optic end-face.
30. The method of claim 27, wherein processing the image further includes:
inspecting the image using the scale relationship.

31. A method for, at least partially, calibrating an imaging system, the method comprising:
- (a) selecting a characteristic having a known value, the characteristic associated with each of a plurality of objects;
 - (b) acquiring, using the imaging system, an image of at least a portion of the characteristic of an object of the plurality of objects;
 - (c) finding the characteristic in the image and measuring the characteristic in the image to provide a measured value;
 - (d) calibrating, at least partially, the imaging system by calculating a scale relationship between the image and the object, using the measured value and the known value; and
 - (e) processing the image using the scale relationship.

31. The method of claim 30, further comprising:

- (f) repeating (b) – (e) with each of the plurality of objects.